TITLE OF THE INVENTION

DOOR CONTROL DEVICE FOR REFRIGERATORS AND REFRIGERATOR WITH THE DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of Korean Patent Application No. 2003-4131, filed January 21, 2003, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention relates, in general, to a door control device for refrigerators, and a refrigerator with such a device. More particularly, the present invention relates to a door control device for refrigerators which controls the open angle of a refrigerator door as a user desires, maintains the selected open angle of the door, and dampens a door closing action to retard the energy generated from the door closure. The present invention also relates to a refrigerator having such a door control device.

2. Description of the Related Art

[0003] As is well known to those skilled in the art, refrigerators are domestic appliances which keep food and drink cool, for a desired lengthy period of time, while maintaining the freshness of the food and drink. A refrigerator typically comprises a freezer compartment and a refrigerator compartment, with a door provided on each compartment to close the compartment.

[0004] Refrigerators are typically arranged side by side with other kitchen furniture or appliances, such as a kitchen sink or a microwave oven. A large-sized refrigerator may be installed in a specified recess formed in a kitchen wall. Due to such an arrangement of the refrigerators, there sometimes occurs interference between the doors of a refrigerator and neighboring furniture, appliances, or the kitchen wall. As a result, the refrigerator doors are easily damaged and are inconvenient for users while opening or closing the doors.

[0005] In an effort to solve such problems, the inventors of the present invention proposed a door control device for allowing a user to control the maximum open angles of refrigerator

doors, as disclosed in Korean Patent Application No. 2002- 53288. However, the conventional door control device is problematic in that a user is forced to loosen and tighten bolts to adjust the maximum open angles of refrigerator doors, making the device inconvenient for the users. In addition, the device only allows a user to adjust the maximum open angles of refrigerator doors, so it is difficult to control the open angles of the refrigerator doors as users desire, or to maintain the selected open angles of the refrigerator doors.

SUMMARY OF THE INVENTION

[0006] Accordingly, it is an aspect of the present invention to provide a door control device for refrigerators, which controls the open angle of a refrigerator door as a user desires, maintains the selected open angle of the door, and dampens a door closing action to retard the energy generated from the door closure. It is another aspect of the present invention to provide a refrigerator having the door control device.

[0007] Additional aspects and advantages of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

[0008] The foregoing and/or other aspects of the present invention are achieved by providing a door control device for a refrigerator having a refrigerator door, including a movable body coupled to the refrigerator door, wherein the movable body is arranged to move in opposite directions in accordance with opening and closing actions of the refrigerator door, and a control unit controlling an opposite directional movement of the movable body in a multi-stage manner.

[0009] Also, a guide element contains the movable body, in order to guide the opposite directional movement of the movable body.

[0010] Also, a link bar is hinged at a first end thereof to an end of the movable body, and is connected at a second end thereof to the refrigerator door.

[0011] Also, the link bar is hinged to the refrigerator door.

[0012] Also, the movable body is provided with a plurality of grooves formed along a longitudinal side surface thereof.

[0013] The foregoing and/or other aspects of the present invention are also achieved by providing a door control device for a refrigerator having a refrigerator door, including a movable body coupled to the refrigerator door, wherein the movable body is arranged to move in opposite directions in accordance with opening and closing actions of the refrigerator door, and a dampening unit dampening a rearward movement of the movable body during a door closing action, thus retarding energy generated from door closure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] These and/or other aspects and advantages of the invention will become apparent and more readily appreciated from the following description of preferred embodiments, taken in conjunction with the accompanying drawings of which:

FIG. 1 is an exploded perspective view of a part of a refrigerator having a door control device, according to an embodiment of the present invention;

FIG. 2 is a top view of the part of the refrigerator having the door control device of the present invention; and

FIG. 3 is a top view of the part of the refrigerator having the door control device of the present invention, and showing the operation of the door control device of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] Reference will now be made in detail to the present preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to the like elements throughout. The embodiments are described below in order to explain the present invention by referring to the figures.

[0016] FIG. 1 is an exploded perspective view of a part of a refrigerator having a door control device according to an embodiment of the present invention. FIG. 2 is a top view of the part of the refrigerator having the door control device. FIG. 3 is a top view of the part of the refrigerator having the door control device, showing the operation of the door control device of the present invention.

[0017] As shown in FIGS. 1 and 2, the door control device according to the present invention is used with a refrigerator 100. The refrigerator 100 having the door control device is configured as follows.

[0018] The refrigerator 100 comprises a cabinet 101 with storage compartments, typically a freezer compartment and a refrigerator compartment, with doors 102 hinged to the cabinet 101 to close the respective storage compartments. For ease of description, only one door 102 is shown in the drawings. The refrigerator 100 also has a door control device according to the present invention. The door control device includes a leg casing 103 which is installed in a lower portion of the cabinet 101. A longitudinal movable bar 104 is axially arranged in the leg casing 103 such that the bar 104 is axially moved under the guide of a channeled rail 105 in opposite directions. A longitudinal side surface of the movable bar 104 is uneven, with four grooves 10a, 10b, 10c and 10d formed along the uneven surface of the bar 104 at regular intervals. The channeled guide rail 105 is axially installed in the leg casing 103 to hold the movable bar 104 and to guide any axial movement of the bar 104. A hinge bracket 106 is mounted to the door 102. A curved link bar 107 is hinged at a first end thereof to an end of the movable bar 104, and at a second end thereof to the hinge bracket 106 at a position spaced apart from a rotating axis of the door 102 by a predetermined distance in a radial direction from the rotating axis. A control chamber 108 is perpendicularly defined at a sidewall of the leg casing 103, and a control unit 200 is installed in the control chamber 108 so as to control the axial movement of the bar 104 in a multi-stage manner. A dampening unit 300 is installed in the leg casing 103 at a position behind the rear end of the movable bar 104, so that the dampening unit 300 dampens a rearward moving action of the movable bar 104 during the door closure. The dampening unit 300 thus dampens the door closing action, and retards the energy generated from the door closure.

[0019] The control unit 200 comprises a retractable locking unit and a first spring 21. The first spring 21 is axially arranged in the control chamber 108, and the retractable locking unit comprises a roller 22 and a roller bracket 23. The roller bracket 23 is elastically supported at a first end thereof by the first spring 21, and rotatably holds the roller 22 at a second end thereof. The roller 22 is thus perpendicularly placed relative to the movable bar 104, and is elastically retractable, so that the roller 22 is sequentially seated into the four grooves 10a, 10b, 10c and 10d while rolling on the uneven surface of the movable bar during an axial movement of the movable bar 104 in the leg casing 103.

[0020] The uneven surface of the movable bar 104, having the four grooves 10a, 10b, 10c and 10d, is smoothly curved to form a waved configuration, so that the roller 22 rolls on the

uneven surface of the bar 104 while being sequentially seated into the four grooves 10a, 10b, 10c and 10d in response to an axial movement of the movable bar 104.

[0021] The dampening unit 300 is an elastic support unit which elastically supports the rear end of the movable bar 104. That is, the dampening unit 300 includes a support member designed as an end plate 31, and an elastic member comprised of two second springs 32. The end plate 31 is mounted to the rear end of the movable bar 104, and the second springs 32 are connected to the end plate 31 at two positions while being arranged in parallel, so that the second springs 32 are brought into contact with a rear end wall of the leg casing 103 during a door closing action.

[0022] The operational effect of the refrigerator having the door control device of the present invention will be described herein below, with reference to FIG. 3.

[0023] When a user (not shown) rotates the door 102 in a direction as shown by the arrow of FIG. 3 to open the door 102 to a desired open angle, the link bar 107, hinged to the hinge bracket 106 of the door 102, is pulled toward the front of the refrigerator 100, so that the movable bar 104, hinged at a front end thereof to the rear end of the link bar 107, is axially moved toward the front of the refrigerator 100. During the forward movement of the movable bar 104, the roller 22 rolls on the uneven surface of the bar 104. In such a case, the uneven surface of the movable bar 104 has the four curved grooves 10a, 10b, 10c and 10d, so that the roller 22, held by the roller bracket 23 and elastically biased by the first spring 21, perpendicularly advances and retracts repeatedly, relative to the uneven surface of the movable bar 104, during the forward movement of the bar 104.

[0024] When the user opens the door 102 to a desired open angle, for example, 90° as shown in FIG. 3, the roller 22 rolls on the uneven surface of the forward moving bar 104, while repeatedly advancing and retracting relative to the uneven surface of the bar 104, until the roller 22 is seated into the third groove 10c, which corresponds to the desired open angle of 90°. When the door 102 is opened to reach the desired open angle of 90°, the user releases his/her handling force from the door 102, so that the roller 22 of the roller bracket 23, biased by the first spring 21, is somewhat strongly pushed into the third groove 10c corresponding to the open angle of 90°. The roller 22 is thus maintained at the position thereof inside the third groove 10c, and the door 102 is maintained at the open position of the open angle of 90°. That is, the

control unit 200, including the roller 22, stops the axial movement of the movable bar 104, and allows the door 102 to be maintained at its open state of the open angle of 90°. Even though external force, such as weight of the door 102, is applied to the door 102 on which the user does not impose his/her physical force, the control unit 200 prevents an undesired axial movement of the movable bar 104. The open angle of the door 102 is thus not changed, but the open door 102 is maintained at its open state at the desired open angle.

[0025] FIG. 3 shows the door 102, which is maintained at its open state, at an open angle of about 90°. However, it should be understood that the open angle of the door 102 may be controlled by the variable position of the roller 22 relative to the four grooves 10a, 10b, 10c and 10d of the movable bar 104, and the door 102 is maintained at a desired open angle determined by the roller seated in either of the four grooves 10a, 10b, 10c and 10d.

[0026] When the user closes the open door 102, the second springs 32 are brought into contact with the rear end wall 103a of the leg casing 103, and elastically support the movable bar 104 moving backward in the leg casing 103 during the door closing action. Therefore, the second springs 32 dampen the door closing action, thus reducing the door closing speed and retarding the energy generated from the door closure. The door 102 is thus smoothly and gently closed without applying impact energy to the refrigerator.

[0027] In an embodiment of the present invention, the movable bar has four grooves to change the open angle of the door between four angles. However, it should be understood that the number of grooves formed on the movable bar may be changed to five or more grooves, or three or less grooves, in order to change the number of open angles of the door which may be selected by a user, as desired. In addition, the grooves for seating the roller of the control unit may be formed on a separate member mounted to a side surface of the movable bar.

[0028] The control chamber which receives the first spring of the control unit may be integrally formed on the sidewall of the leg casing by outwardly depressing the sidewall, as shown in the drawings. Alternatively, the control chamber may be defined in a separate member which is provided at a predetermined position around the sidewall of the leg casing.

[0029] In addition, the end plate and the second springs may be provided on the inner surface of the rear end wall of the leg casing, in place of the rear end of the movable bar. Alternatively, the end plate and the second springs may not be mounted to the inner surface of

the rear end wall of the leg casing or the rear end of the movable bar, but arranged between the rear end wall of the leg casing and the rear end of the movable bar.

[0030] As is apparent from the above description, the present invention provides a door control device for refrigerators, which allows a user to easily control the open angle of a refrigerator door as desired without forcing the user to perform additional work to control the open angle of the door. The door control device also maintains a selected open angle of the door, and dampens a door closing action to retard the energy generated from the door closure. The door control device thus prevents interference between the refrigerator doors and neighboring furniture, appliances or kitchen wall, and is convenient for users of refrigerators. The door control device also prevents rapid door closure.

[0031] Although a few embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.